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varied in their powers, and his mind responsive to a greater variety of impressions.

It is in his ideas, however, that civilized man so greatly overtops the lower world of life. His mind has been for ages pushing deeper and deeper into the realm of the unknown like an eating sea that is cutting its way steadily into the land. Before it lies the unknown, stretching away into the infinite. Behind it lies the known, half or wholly buried beneath the shrouding waters of the sea. The surf line is the line of consciousness, the border between the known and the unknown. Here consciousness mines forever into the coast line of facts, letting every new-gained fact float out to come to rest on the quiet sea bottom, the stores of recent memory lying half visible in the shallow waters, while in the deep sea beyond lie the layers of ancient acquirement which have become to us hereditary capabilities, the native stuff of the mind. What new and deeper powers the senses may yet attain, what new susceptibility the mind, cannot be said. We see rising dimly and shapelessly around us new phenomena, new stuff for thought on which the mind of future man must work, and every new age may safely say to the ages of the past: "There are more things in heaven and earth, Horatio, than are dreamed of in your philosophy."

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## A BRIEF BIOGRAPHY OF THE HALIBUT.

BY G. BROWN GOODE.

THE halibut, *Hippoglossus vulgaris*, is widely distributed through the North Atlantic and North Pacific, near the shores, in shallow water, as well as upon the off-shore banks and the edges of the continental slope down to the depth of at least 400 fathoms. The species has not been observed in the Western Atlantic south of the fortieth parallel; stragglers have occasionally been taken off Sandy Hook, Block island and Montauk point. It ranges north at least to Cumberland gulf, latitude 64°, to Holsteinborg bank in Davis' strait, and as far as Disko and Omenak fiord, latitude 71°, on the coast of Greenland, five or six degrees within the Arctic circle. It occurs along the entire west coast of Greenland, and is abundant about Iceland and at Spitzbergen, in latitude 80°. No one knows to what extent it ranges along the European and Asiatic shores

of the Arctic ocean, but it has been observed on both sides of the North cape, in East and West Denmark, and from the North cape, latitude  $71^{\circ}$ , south along the entire western line of the Scandinavian peninsula, in the Skager Rack and Cattegat, though not, so far as I can learn, in the Baltic sea. The halibut is occasionally seen in the southern part of the North sea and in the English channel, but never, in the Eastern Atlantic, south of latitude  $50^{\circ}$ . There is yet some question whether it is found in the south of Ireland, though some of the largest individuals recorded from Great Britain have been taken in the Irish sea, off the Isle of Man.

On the Pacific coast the halibut, which has been shown by Dr. Bean to be identical with that of the Atlantic, ranges from the Farallones islands northward to Bering straits, becoming more abundant northward. "Its center of abundance," says Bean, "is in the Gulf of Alaska, particularly about Kodiak, the Alexander archipelago and the Shumagins. Large halibut are numerous about the Seal islands, but the small ones have been killed by the seals. I have heard from good authority of their capture as far north as Saint Lawrence bay, near East cape, in Siberia. It has several times been reported from off the heads of Marcus bay, Siberia." It is occasionally taken off San Francisco and about Humboldt bay. In the Straits of Fuca and in the deeper channels about Puget sound it is taken in considerable numbers. A large halibut bank exists in the mouth of the Straits of Fuca, about nine miles from Cape Flattery in a north westerly direction, and the capture of this fish is an important industry to the coast Indians.

The halibut is emphatically a cold-water species. That it should range nine or ten degrees farther south on the American than on the European coast, is quite in accordance with the general law of the distribution of fish-life in the Atlantic; indeed, it is only in winter that halibut are known to approach the shore to the south of Cape Cod, and it is safe to say that the temperature of the water in which they are at present most frequently taken is never, or rarely, higher than  $45^{\circ}$ , seldom above  $35^{\circ}$  and most often in the neighborhood of  $32^{\circ}$ . Its geographic range corresponds closely to that of the codfish, with which it is almost invariably associated, the cod is, however, less dependent upon the presence of very cold water, and in the Western Atlantic is found

four or five degrees—in the Eastern Atlantic at least two—nearer the equator, while the range of the two species to the north is probably, though not certainly, known to be limited relatively in about the same degree. In the same manner the halibut appears to extend its wanderings further out to sea, and to deeper and colder waters than the cod. Although observations on this point have necessarily been imperfect, it seems to be the fact that cod are very rarely found upon the edge of the continental slope of North America beyond the 250-fathom line, while halibut are present in abundance upon the outer slope.

The name of this fish is very uniform in the regions where it is known, though, of course, subject to certain variations in the languages of the different countries, for its characteristic features are so unmistakable that it is rarely confounded with other species. The only fish for which it is mistaken seems to be the turbot of the European coast, with which it sometimes interchanges names. It is said that in Scotland the halibut is frequently called the turbot, and Yarrell has expressed the opinion that in instances where it has been claimed that halibut had been taken in the south of Ireland the turbot was the species actually referred to.

“Halibut” and “holibut” are words which are as old as the English language. In Germany the fish is called “heilbutt” or “heilgebutt;” in Sweden, “hällefisk” or “hälleflundra,” while in Holland it is known as the “heilbot.”

In studying these names it should be borne in mind that “but” or “bott” is only another word for flounder or flat fish, and that the English, Dutch, German and Scandinavian prefixes to this word or the equivalent word flounder are presumably of the same meaning. A false derivation has been imagined for the name, which is exemplified in the German word “heilgebutt” just mentioned, and also in an English spelling, which is sometimes encountered, “holybut.” This idea is without foundation, for the halibut has never been revered more highly than any other species of flat fish, and the derivation is as fanciful as “haul-a-boat,” which our New England fishermen have frequently assured me was the proper name, having reference to the size and strength of the fish. The true derivation of the word may best be understood through a study of its Scandinavian names, from which it appears that the prefix has reference to the holes or deep

places at sea in which the fish is found, and that the name simply means "a deep-sea fish," or "a deep-sea flounder."

The general distribution of the halibut having been sketched in outline, it may, perhaps, be appropriate to discuss more fully the range and abundance of the fish upon the coast of North America, and to describe the regions where it is sought by American fishing vessels.

Halibut are taken very abundantly on Holsteinborg bank, at the southern entrance to Davis' strait, latitude  $67^{\circ}$  north and longitude  $54^{\circ}$  to  $56^{\circ}$  west, where several Gloucester schooners have in past years obtained large cargoes of salted fish. In Etzel's "*Grönland*," it is stated that halibut are taken chiefly in the southern part of North Greenland, and everywhere on the shoals among the islands in the district of Egedesminde, especially about Agto, Riskol and Ikerasak, in latitude  $68^{\circ}$ , and somewhat less near Disko, in latitude  $76^{\circ}$ . They are captured most abundantly in the spring and fall. They are even taken, at greater depths, as far north as Omenak, in latitude  $71^{\circ}$ . In a later work Rink asserts that "the Netarnak or larger halibut is found on the banks, as well as in different places outside the islands, up to  $70^{\circ}$  north latitude, in depths of from thirty to fifty fathoms." In the same later work Rink remarks that halibut are plentiful in the fall about Egedesminde, and especially about Agto, the southernmost outpost of North Greenland. Etzel goes on to state, regarding the occurrence of halibut in South Greenland, that in July and August they are taken on the outer coast and among the islands at depths of thirty to fifty fathoms, while in winter they frequent deeper regions and are but seldom seen. Rink narrates that in 1809 there were taken among the islands off Godthaab ( $64^{\circ} 8'$  north latitude) 2000 halibut, and that in a single half-day two boats took over one hundred. They are rarely taken in the district of Julianshaab, in latitude  $60^{\circ} 43'$  north.

Peter C. Sutherland, writing of Riskol bank, in 1850, stated that halibut were then very abundant in that locality, and that the cod-fishing vessels which visited Davis' strait every season used them to bait their hooks, though the supply far exceeded the demand for this purpose.

Sutherland narrates that on the return of the Penny expedition, in 1851, when crossing the Arctic circle, in longitude  $53^{\circ}$ , the sailors put over lines baited with pork and hooked a cod and a halibut at the depth of forty fathoms.

The most northern occurrence of the halibut on the western side of Davis' strait is that recorded by Mr. Ludwig Kumlien, naturalist of the Howgate expedition, who saw a large individual taken by the Eskimos off the mouth of Davis' straits, near latitude  $64^{\circ}$  north.

Richardson, in the *Fauna Boreali-Americana*, speaks of the occurrence of the species on the Greenland coast, but seems to have no authentic information of its having been observed even as far north as Labrador on the opposite side.

There is no reasonable doubt that the halibut is found along the entire eastern coast of Labrador, though there is no other published record of its occurrence north of Red bay, in the Straits of Belle Isle, near latitude  $51^{\circ} 40'$  north, where it was observed by Mr. Horatio R. Storer, several individuals having been taken during his stay at that place in the summer of 1849.

It is abundant in certain parts of the Gulf of St. Lawrence, especially the island of Anticosti, and is also found along the entire coasts of Newfoundland and the eastern shores of Nova Scotia.

In June, 1878, the schooner *G. P. Whitman*, of Gloucester, caught a fare of halibut in two to twelve fathoms of water near Green point, Newfoundland. The crew said that they could see the fish lying on the bottom in shallow water.

Capt. George Olsen, schooner *Proctor Brothers*, arrived at Gloucester, August 2, 1880, with 22,000 pounds' weight of fresh halibut from Anticosti. He reported halibut plenty then at the western end of the island close inshore—within half a mile; he saw the halibut sporting near and on the surface; he found they would not bite, as on the banks, at halibut bait, and since fresh herring or capelin could not be obtained, could only get a partial trip of halibut. They were good fish, weighing sixty to eighty pounds.

According to M. H. Perley halibut are found in the Bay of Fundy up to its very head, where they are taken in summer in Cumberland bay, near the light-house off Apple river, and also in West bay. He states that they are also found on the south shore of the Bay of Fundy, and abundantly from Cape Split to Brier island, as well as in the Annapolis basin. Perley's report was prepared in 1852, and there is no evidence of diminution in that region since he wrote.

Mr. J. Matthew Jones tells me that halibut are occasionally

taken at Five islands in the Basin of Minas, but that this is of rare occurrence.

I am indebted to Captain Ashby for the following facts about the southern limits of the distribution of the halibut: He has never known them to be found south of Sandy Hook, where large ones are occasionally taken in winter. In May, 1876, the schooner *Cartwright*, fishing ten miles south-east of Montauk point, caught many halibut. In February, 1876, some Noank smacks caught a few halibut about eight miles from land, off the south-east point of Block island. Within the last forty years one or two halibut have been taken off the outer shore of Fisher's island. He has never known any to be taken in Long Island sound. Halibut are sometimes taken in three fathoms of water among the breakers off Nantucket, in "blowy weather." Forty years ago they were abundant about Gay head and Noman's land. There has been no systematic fishing there lately, but some individuals have probably been taken.

The local papers chronicled the capture, on May 1, 1876, off Watch hill, Rhode Island, of an eighty-pound halibut, the first taken in that locality for many years.

A halibut is occasionally taken along the shores of Maine and Massachusetts, but so seldom that a capture of this kind by one of the inshore fishermen is always mentioned in the local papers.

*Abundance.*—Half a century ago the halibut was extremely abundant in Massachusetts bay, and striking stories of their great plenty and voracity are narrated by some of the early fishermen of Cape Ann. Of late years, however, few have been found except in deep water on the off-shore banks.

Captain Chester Marr says that in early days halibut were exceedingly abundant on George's bank. He has seen a "solid school of them as thick as a school of porpoises" feeding on "lant." At another time "the whole surface of the water as far as you could see was alive with halibut; we fished all night and we did not catch a single codfish. The halibut would not let the hook touch the bottom; we caught 250 in three hours; the crews of some vessels would go and cut the fins off the fish and let their bodies go. No wonder that they were broken up. We thought they were always going to be so. Never made no calculations that we were going to break them up. The southern

side of George's was a kind of 'mother-place' for fishing halibut." There was no great abundance of halibut on George's after 1848.

The abundance of the species on the off-shore banks before the over-fishing took place is almost beyond credence. The following is selected from a large number of instances of fishermen's successes: The schooner *Mary Carlisle*, of Gloucester, made nine trips to the banks in 1871. Her catch was 350,188 pounds of halibut and 58,759 pounds of codfish; her net stock amounted to \$17,275.53 for about eleven months' work, from December 27, 1870, to November 21, 1871. On one trip in the spring she brought in 58,553 pounds of halibut and 6900 pounds of codfish, her net stock reaching the sum of \$4738.75, and her crew sharing \$236.25 each from a voyage of thirty-four days. She had ten men in her crew, each of whom during the season shared \$858.62. In three years this vessel stocked a total of \$46,871, divided as follows: 1869, \$17,549; 1870, \$12,047; 1871, \$17,275.53.

The presence of so important a food-fish in America did not long escape the observations of the early English explorers. Captain John Smith, in his *History of Virginia*, wrote: "There is a large sized fish called hallibut, or turbut: some are taken so bigg that two men have much a doe to hall them into the boate; but there is such plenty, that the fisher men onely eat the heads & finnes, and throw away the bodies: such in Paris would yeeld 5. or 6. crownes a peece: and this is no discommodity."

The halibut is surpassed in size by only three fishes on the Atlantic coast—the swordfish, the tunny and the tarpum. It is said, by experienced fishermen, that there is a difference in the size of the two sexes, the females being much the larger; the male, they tell us, rarely exceeds fifty pounds in weight, and is ordinarily in poor condition and less desirable for food. The average size of a full-grown female is somewhere between 100 and 150 pounds, though they are sometimes much heavier. Captain Collins, who has had many years' experience in the Gloucester halibut fishery, assures me that he has never seen one which would weigh over 250 pounds, and that a fish weighing over 250 pounds is considered large. There are, however, well authenticated instances of their attaining greater dimensions. Captain Atwood, in a communication to the Boston Society of Natural



History in 1864, stated that the largest he had ever taken weighed, when dressed, 237 pounds, and would probably have registered 300 pounds when taken from the water. In July, 1879, the same reliable observer saw, at Provincetown, two individuals taken near Race point, one of which weighed 359 pounds (302 pounds when dressed), the other 401 pounds (322 pounds when dressed).

There is a tradition in Boston that Mr. Anthony Holbrook, one of the early fish-dealers of that city, had in his possession a halibut, taken at New Ledge, sixty miles south-east of Portland, which weighed over 600 pounds. This story, which is recorded by Storer in his "*Fishes of Massachusetts*," Captain Atwood believes to be untrue. Halibut weighing from three to four hundred pounds, though unusual in comparison with the ordinary size, are by no means rare. I have before me records of ten or twelve such fish captured on the New England coast during the past ten years. Nilsson, has mentioned the capture, on the Swedish coast, of an individual which weighed 720 pounds. There are stories of halibut ten feet in length; a fish weighing 350 pounds is between seven and eight feet long and nearly four feet in width. The largest halibut are not considered nearly so good for table use as those of less than 100 pounds weight. A fat female of eighty pounds is, by good judges, considered to be in the highest state of perfection, while males are not so highly esteemed. Small halibut, known as "chicken halibut," ranging from ten to twenty pounds, are much sought after by epicures, and bring a high price in the New York and Boston markets. They are, however, comparatively rare, and those weighing ten pounds or less are rarely seen; the smallest recorded from our coast was about five inches in length, and was taken by Professor Verrill in a dredge-net in the Strait of Canso.

The halibut of the Pacific are apparently similar in dimensions to those of New England. Mr. Anderson, inspector of fisheries for British Columbia, states that in the waters of Puget sound they attain a weight of 200 pounds.

The wholesale dealers of Gloucester, in buying fresh halibut from the fishermen, recognize two grades; one, which they call "gray halibut," they consider to be of inferior value, and pay a lower price for. The gray halibut are distinguished by dark cloudings or blotches upon the under side, which in the most

marketable fishes are pure white. Almost all the largest halibut are classed among the grays. Fishermen claim that there is no actual difference between the gray and white fish, and it is a fair question whether they may not be right.

*Migrations.*—It is useless to attempt to describe at this time the migrations of the halibut from place to place; although much information has been received upon this subject, the problem requires long and careful study.

Captain Benjamin Ashby, of Noank, Connecticut, who is familiar with the fisheries south of Cape Cod, informs me that halibut frequent the deepest water in the spring and fall, and that in May and June they come up in the shoal water, in sixty or seventy fathoms, while in July they begin to go out again into deep water, and by the latter part of the month are on the way into the gully near the north-east part of George's bank.

Captain Joseph W. Collins, undoubtedly the best authority upon the subject, briefly expresses his views as follows: "Halibut are found in the deep water—say from 100 to 250 fathoms in depth—on the edge of all the banks from George's to the Grand bank the year round. Sometimes, however, they seem to be more numerous in comparatively shallow water in the winter and early spring. This was the case in the winters and springs of 1875-'76 and 1876-'77, as well as in the year preceding, but in 1878 there was no great catch of halibut in less than 100 fathoms on any of the banks. The great schools that were found in the western part of the Grand bank in February and March, 1876 and 1877, appeared to be migrating. The fish that were found to the south of latitude  $44^{\circ}$  north were mostly small-sized white halibut. They went off the bank into deep water, and nobody knew what became of them. Those that were caught to the north of this parallel were mostly large gray fish, and were traced as far as Saint Peter's bank. These are possibly the same fish—they are certainly the same kind of fish—that struck in on the western coast of Newfoundland and in the summer months in pursuit of capelin."

Capt. George A. Johnson states that the large halibut generally frequent the outer and deeper part of the banks, while the little "bull fish" lie inside, on shallower ground, and are caught on the inner end of the trawl lines; sometimes, however, the large halibut also come up on the shallow grounds.

On the coast of Newfoundland, Anticosti and Labrador, in summer, halibut frequently run inshore after capelin. When in shallow water near the shore they are usually wild and very active. Within eight years the fishermen have extended their fishing much farther out to sea ; previous to that time the greater part of the halibut were taken on top of the Grand bank in thirty to fifty fathoms of water, but after the beginning of April the fish went elsewhere, and the fishermen lost sight of them. They soon learned, however, to follow them down the slopes of the banks, though before 1876 they had rarely fished in water deeper than seventy to ninety fathoms. Since that time, as has already been stated, fishing has been carried into twice or three times that depth. All that can at present be said in explanation of their movements is, that they occur in great schools, which consume the available food in any one locality, and are soon obliged to shift their position to some other place where they can find fresh supplies. It does not seem possible that their migrations can be caused by conditions of temperature or are in connection with their breeding habits. During the breeding season the schools sometimes remain for months in one locality, and these places are generally of limited extent. While spawning but little if any food is found in their stomachs.

*Food.*—They are large-mouthed, sharp-toothed and voracious, and though especially adapted for life upon the bottom, doubtless feed largely upon crabs and mollusks. They are especially fond of fish of all kinds ; these they waylay, lying upon the bottom, invisible by reason of their flat bodies, colored to correspond with the general color of the sand or mud upon which they rest. When in pursuit of their prey they are active, and often come quite to the surface, especially when in the summer they follow the capelin to the shoal water near the land. They feed upon skates, cod, haddock, menhaden, mackerel, herring, lobsters, flounders, sculpins, grenadiers, turbot, Norway haddock and bank clams. Captain Ashby tells me that common flounders and flat fish are among their most favorite food ; these they follow upon the shoals of George's and Nantucket, lying in wait for them on the sand-rips and seizing them as they swim over. He has seen half a bushel of flat fish stowed away tightly in the stomach of a single halibut. He has often seen halibut chasing flat fish over the surface of the water. About Cape Sable their

favorite food seems to be haddock and cusk. He has seen eight or ten pounds of haddock and cod taken out of one of them. When they are on the shoals they are sometimes filled with flat fish, haddock, cusk, sculpin and herring, but when in deep water he has found very little food in them. They eat crabs and other crustaceans, but shells are rarely found in their stomachs, except those of clams and mussels.

Captain Hurlbert tells me that when the vessels are dressing codfish on the Grand banks, and the backbones and head are thrown overboard, these are frequently found in the stomachs of halibut taken in the same locality.

Mr. William H. Wonson, of Gloucester, has seen live lobsters six inches long taken from the stomach of a halibut. Captain Mar states that they feed on whiting, mackerel and herring. He remarks: "Halibut will drive off any kind of fish and take charge of the ground."

At the meeting of the Boston Society of Natural History, in 1852, Dr. W. O. Ayres stated that he had seen a block of wood, a cubic foot in dimensions, taken from the stomach of a halibut, where it had apparently lain for a long time. Capt. George A. Johnson found an accordeon key in one of them. Olafson, in 1831, studying them on the coast of Greenland, found not only pieces of iron and wood in their stomachs, but in one individual a large piece of floe ice. Captain Collins has observed that they often kill their prey by blows of the tail, a fact which is very novel and interesting. He described to me an incident which occurred on a voyage home from Sable island in 1877: "The man at the wheel sang out that he saw a halibut flapping its tail about a quarter of a mile off our starboard quarter. I looked through the spy-glass and his statement was soon verified by the second appearance of the tail. We hove out our dory and two men went in her, taking with them a pair of gaff-hooks. They soon returned bringing not only the halibut, which was a fine one of about seventy pounds weight, but a small codfish which it had been trying to kill by striking it with its tail. The codfish was quite exhausted by the repeated blows, and did not attempt to escape after its enemy had been captured. The halibut was so completely engaged in the pursuit of the codfish that it paid no attention to the dory, and was easily captured."

The observations of the halibut fishermen are full of interest

to the naturalist, and it is from them that we derive all our knowledge of the habits of the animal while feeding. The halibut, following in after the schools of capelin which visit the shores of Western Newfoundland, Southern Labrador and the islands of Anticosti and Miquelon to spawn, have often been found in great abundance in very shallow water, not above five to ten fathoms deep.

Fishermen who have watched halibut under such circumstances, and have been able to see them perfectly well in the clear water, state that these fish exhibit marked peculiarities in biting at baited hooks on a trawl. The halibut will advance to the bait, apparently smell of it, and then retreat four or five feet from it, always lying on the bottom, head toward the bait, as if watching it. After repeating this performance several times—generally three or four—the fish seems to make up its mind to eat the bait, and suddenly darting toward it, swallows it down with a gulp.

The George's hand-line fishermen believe that halibut often strike the baited hooks with their tails. It is not uncommon on board a George'sman to hear a fisherman remark: "There's a halibut around; I felt him strike my gear." When a halibut has announced his presence in this way it is scarcely necessary to say that every effort is put forth by the fisherman to attract the fish to his hooks, and if a man is sufficiently skillful he generally succeeds in capturing the fish.

There is much rivalry in a vessel's crew when it is known that halibut are on the ground where she is lying, and every known device is adopted to entice the fish to bite at the hooks. Strips of newly-caught haddock, with fresh blood still on them, are considered the best bait. Two, three, or more of these are put on a hook, which is passed through the thickest end of the strips, while the pointed ends of the bait are left to float about in the water. Where there is a tide running these closely resemble the movements of a small fish. The hooks are usually "pointed" with herring bait. After the bait is on the hooks many fishermen add (as they believe) to its attractiveness by mopping it in the slime of a halibut, if one has been previously caught. This is done by wiping the baited hook back and forth over a halibut. The lure thus prepared, the fisherman lowers his apparatus to the bottom, and by a skillful manipulation tries to induce the fish to bite. Sometimes he will let the tide sweep his "gear" along the bot-

tom, and again he will endeavor to give his baits the appearance of life by slowly pulling them up a short distance from the ground. If he finally succeeds in hooking a halibut, all his art is required to bring the fish to the surface and land it safely on deck. If it be a large fish it almost invariably makes a desperate fight to escape. It may, perhaps, come up easily for ten or fifteen fathoms, when it suddenly takes a plunge downward. Surge! surge! goes the line through the hands of the fisherman, who knows very well that he must "play" his fish or else his line will be snapped like pack thread. This operation may be repeated several times, and it is not uncommon for a large and particularly "wild" halibut to go almost to the bottom after having been hauled nearly to the surface of the water. At last the fish is alongside, and the shout of "Gaffs! gaffs here!" brings two or three of the nearest men to the side, armed with long-handled gaffs. If the fish is exhausted the gaffs are quickly hooked into his head and he is dragged unceremoniously over the rail and falls with a heavy thump on deck, which usually resounds with the strokes of his powerful tail until he is stunned by repeated blows with a killer. If the halibut is still active when he comes alongside, much dexterity is required to gaff him. He makes desperate attempts to escape, and thrashes the water into foam with his tail.

When the fish is on deck and killed, his captor cuts his mark in a conspicuous manner, generally on the white surface of the halibut, which is the underneath portion when the fish is in the water, but is invariably turned upward after it is taken on deck; this method being adopted to prevent the blood from settling on that side and thus making the fish look dark colored or gray. The George's fishermen frequently bleed their halibut by making a cut across the tail.

Halibut caught in shallow water are exceedingly active, and frequently make a hard fight. When a fish of 100 to 200 pounds weight is raised from the bottom on a trawl, he usually starts off at great speed, making the dory spin around in his effort to escape. Of course he cannot run far in one direction, for the weight of the gear is too much for him to drag over the bottom. After a while he is sufficiently tired out to be hauled alongside of the dory, and if the fisherman is expert enough to hit his fish two or three smart raps over the nose with a "killer," the halibut

succumbs and is pulled into the boat. It is often the case, however, that considerable difficulty is experienced in effecting the capture of a large fish, and it is by no means an unusual circumstance for one to escape.

A fisherman related to me an incident which he witnessed in the shallow water near Miquelon beach, Newfoundland. Two men were out hauling a trawl in about seven fathoms of water, a short distance from the vessel. They worked along quietly for a while, when suddenly the dory started off at a tremendous speed, towed by a big halibut which had been started from the bottom, and which, in its efforts to escape, darted about wildly, pulling the boat after it and careening her at a considerable angle. By dexterous management it was, after a while, brought to the surface; the man aft quietly pulled up on the ganging until the fish broke water, when an iron gaff was driven into its head. The doryman had made the mistake of gaffing his fish before it was stunned, and as a result, no sooner was the gaff in the halibut than the latter made a tremendous splurge, twisted the implement out of the fisherman's hand, and, getting a fair start, made a run to the bottom. Another quarter of an hour was required to again get it alongside of the dory. This time there was no gaff, and to serve in its place the doryman had cast off the trawl anchor from the buoy-line. When he got the halibut's head above water he drove the fluke of the sixteen-pound anchor into the fish, which he made sure he would hold that time. But he was mistaken. The halibut, as before, escaped, taking with it the anchor, almost pulling the man out of the boat, which was nearly capsized, and going off with the hook, too, which this time it tore from the trawl.

The halibut, in its turn, is the prey of seals, of the white whale and of the various large sharks, especially the ground shark, or sleeping shark, in the stomachs of which they have sometimes been found; their sides, I am told by Captain Collins, are often deeply scarred, probably by the teeth of the sharks, or in their early lives by mouths of larger individuals of their own kind.

*Spawning.*—There is great diversity of opinion regarding their spawning season. Some fishermen say that they spawn at Christmas time, in the month of January, when they are on the shoals. Others declare that it is in summer, at the end of June. Capt. George A. Johnson, of the schooner *Augusta H. Johnson*, of

Gloucester, assures me that halibut "spawn, just like the human race, at any time of the year." In April, 1878, he was fishing on Quereau bank and found large and small halibut, the large ones full of spawn. In May he was on Le Have bank, where he found only small male fish full of milt; in June he was on Le Have again, fishing in shallow water, where he found plenty of "small bull fish, with their pockets full of milt;" in July he was again on Quereau bank, where he found a school of small and big male and female fish, all apparently spawning or ready to spawn, "with milt and pees soft;" in August he was on the outer part of Sable island, where he found females full of spawn.

Captain Ashby, speaking of the halibut on George's banks, states that roe is always found in them in May and June. The roes of a large halibut caught by him in 1848 on the south-west part of George's, and which weighed 356 pounds, after it had been dressed and its head removed, weighed 44 pounds. He states that the halibut in this region have spawn in them as late as Connecticut vessels continue to catch them, or until September. He has seen eggs in halibut of twenty pounds weight, and thinks they begin to breed at that size. The spawn of the halibut is a favorite food of the fishermen of Southern New England, though never eaten by those of Cape Ann.

Captain Hurlbert, of Gloucester, tells me that on the Grand banks of Newfoundland the spawning halibut school used to come up in shoal water in forty or fifty fathoms. In August, 1878, he found many with the spawn already run out. At that time several Gloucester fishermen reported that the halibut on Le Have and Quereau banks were full of spawn. Captain Collins told me that in July and August, and up to the first of September, they are found here with the ovaries very large, and are often seen with the ova and milt exuding. The ovaries of a large fish are too heavy to be lifted by a man without considerable exertion, being often two feet or more in length. At this time very little food is found in their stomachs. In September, 1878, the Fish Commission obtained from Captain Collins the roes of a fish weighing from 190 to 200 pounds, taken by the schooner *Marion* on the 13th of the month on Quereau bank. This fish was taken at the depth of 200 fathoms, and the temperature of the water was roughly recorded at 36° F. These ovaries were put into a basket with ice and brought to the laboratory of the Fish Com-



mission, where they were found to weigh seventeen pounds two ounces. Part of the eggs were nearly ripe, and separated readily, while others were immature and closely adherent to each other. A portion of the roe, representing a fair average of the size of the eggs, was weighed, and was found to contain 2185 eggs; the weight of this portion was two drams. The total number of eggs was from this estimated to be 2,182,773. It is not yet known whether the eggs float or rest upon the bottom, nor is it known how long is the period of incubation, nor what is the rate of growth of the fish. As has already been mentioned, young fish are very unusual; the smallest ever seen by Captain Ashby in Southern New England was taken on Nantucket shoals, and weighed two and a half pounds after it had been eviscerated.

*Abnormal individuals.*—"Left-handed halibut" are sometimes taken. Perhaps one out of five thousand is thus abnormal in its form, having the eyes upon the left rather than upon the right hand side of the head.

Halibut with dark spots or patches on the under side, of the same dark color as the back, are occasionally taken. These are called by the fishermen "circus halibut." They are generally of medium size and thick, well-fed fish.

The history of the halibut fishery has been a peculiar one. At the beginning of the present century these fish were exceedingly abundant in Massachusetts bay. From 1830 to 1850, and even later, they were extremely abundant on George's banks; since 1850 they have partially disappeared from this region; the fishermen have recently been following them to other banks, and since 1874 out into deeper and deeper water, and the fisheries are now carried on almost exclusively in the gullies between the off-shore banks and on the outer edges of the banks in water 100 to 350 fathoms in depth. The species has in like manner been driven from the shallow fishing grounds on the coast of Europe; there is, however, little reason to doubt that they still are present in immense numbers within easy access off the British and Scandinavian coasts, and that a good fishery will yet grow up when the fishermen of those countries shall have become more enterprising.

*A Prophecy.*—In the year 1879 there were forty vessels, of 3168 tons, from Gloucester, Mass., employed exclusively in the fresh-halibut fishery; also vessels hailing from New London and the eastern end of Long island are employed, except during the

winter months, chiefly in the capture of halibut, which they carry to New York. These vessels, however, take also a considerable quantity of codfish. In addition to the Gloucester vessels already mentioned, which fish for halibut throughout the year, there were eight vessels, of 647 tons, which fished for halibut in the winter season and engaged in other fisheries, generally the cod fishery, from May to November.

The vessels of the George's fleet, though their chief object is the capture of cod, take considerable quantities of halibut, which are brought to Gloucester fresh; a few also are sometimes taken by the Western bank cod fleet, and a still smaller quantity by the Boston market fleet. In 1879, and probably in 1880, there were a few small vessels on the coast of Maine which engaged in the fresh-halibut fishery for three or four months in the summer, carrying their fish chiefly to Portland. The total catch of halibut on the New England coast for 1879 is estimated at 14,637,000 pounds, distributed as follows:

Gloucester halibut fishery .....	8,300,000
Gloucester vessels fishing in winter only.....	1,000,000
New York halibut catchers.....	3,000,000
Gloucester, George's fleet (incidental).....	2,000,000
Western bank cod vessels (incidental).....	37,000
Small vessels on the coast of Maine and Massachusetts.....	300,000

Total.....14,637,000

In 1885 the halibut fleet of Gloucester is reduced to one-fourth of its former size, and the total catch is estimated at from three to five million pounds.

It is evident that within a few years the American off-shore halibut grounds will be so depleted that the fresh-halibut fishery on our coasts will be abandoned. We shall then derive our chief supply from the waters of Greenland and Iceland, where several vessels go each year to bring back cargoes of salt "flitches." Halibut will come into our markets only in a smoked condition, and the species will be as unfamiliar in our fish-markets as it is in those of the old world. The life-history of the species must be recorded now, for it can never be made so completely hereafter. This is the writer's excuse for having presented in this place so full a biography of the halibut.

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## TRACES OF PREHISTORIC MAN ON THE WABASH.

BY JOHN. T. CAMPBELL.

**D**URING the year 1884 I was employed as civil engineer for the construction of a levee from the mouth of Big Raccoon creek on the east side of the Wabash river, which is the west boundary of Parke county, Indiana. The levee was built as close to the river bank as practicable, and was aimed to be the height